Superior switching technology

The printed coil technology of the new universal factor 1 sensor *uprox*®+ permits the flexible design of variable housing styles and opens new fields of application

At the end of 2004, eleven years after the development of the factor 1 *uprox*® sensor with a ferrite core, the sensor specialist TURCK introduced the new sensor plus version with printed coils. In the meantime, the adaptable inductive sensor is employed in various installations. A&D talked with TURCK's Product Manager Oliver Marks about his "baby", and with Christian Wolf, the new member in TURCK's Company Management and Axel Kuhbier, Product & Marketing Manager at Escha, about the new sales cooperation on connector products.

"*uprox*®+ is a real high-tech sensor, which clearly distinguishes itself from all competitor products", states Oliver Marks, the manager in charge of position and proximity sensors of the Mülheim-based sensor and fieldbus specialist.

"Pricewise we remain within the known limits. The new sensor is capable of fulfilling various tasks, for which a variety of different sensor versions had to be kept on stock until today. This reduces costs – both on the part of the supplier and the customer. Customers are becoming increasingly aware of the fact that the total costs of a system installation are not determined by mere component prices. *uprox*®+ is the standard sensor for all applications. If you include the costs of the entire process in the calculation, *uprox*®+ is capable of significantly optimising the costs of a machine or system", he emphasizes.

Positioning

Since approx. 30 years, inductive sensors have been increasingly employed in order to eliminate the various problems associated with mechanical switches. Due to the wear-free operation principle, inductive sensors have become more and more prevalent in industrial automation. Inductive sensors, however, also pose some problems, for instance, the limited temperature range, the lack of magnetic field immunity and material dependence of the sensor. For these cases, various special sensor types were developed, so that the original inductive sensor was supplemented by a wide range of special versions.

"In order to be able to offer "the universal" inductive sensor, TURCK developed the *uprox*® series in 1993", explains Oliver Marks. These novel inductive sensors operated without a ferrite core and were technologically far advanced in comparison to the ferrite core sensors available at that time due to their air coil system. With this principle, the switching distance for all metals is identical ("factor 1") and since the *uprox*® does not incorporate a ferrite core, it is inherently immune against disturbing magnetic fields, as occurring, for instance, during welding operations. With the new sensor family *uprox*®+ Turck has made another important move towards providing the universal inductive sensor.

Technology

The printed coil of the *uprox*®+ is not only easier to produce in contrast to the conventional sensor with ferrite core and wound coil, but it also permits the design of flexible housing styles. "The *uprox*®+ consists of two pairs of emitter and receiver coils; and it is also possible to include further compensation coils in the layout", explains Oliver Marks. This further development of the known and proven *uprox*® principle with a single emitter and two receiver coils, which is the "predecessor" of all differential transformer systems, enhances the potentials of inductive sensing technology.

This product innovation additionally builds on pioneering production technology. By dividing the emitter coil into two independent systems, the associated emitter and receiver coil pairs can now be separated. As a result, it is possible to construct internal circuit layouts, which are optimally adapted to the respective sensor housing style (e.g. rectangular or threaded barrel versions) and perfectly meet the according geometric requirements. Additionally, the high precision of the printed coils clearly improves signal evaluation in the limit ranges.

The new design offers even higher switching distances as well as an unknown level of flexibility in coil construction. With the *uprox*®+, the distinct disadvantage inherent to sensors with extremely large switching distances has been overcome, i.e. the difficult and hardly feasible mounting practice," states Oliver Marks. "In concrete term this means: highest operating distances, reduction factor 1 for all metals, simple and uncomplicated mounting procedures, recessed mounting of flush sensors, drastically reduced metal-free zones and partial embedding of non-flush sensor types. And, of course, the sensor's high degree of protection rated with IP68/69K, its magnetic field immunity and high level of EMC should be clearly kept in mind," concludes Oliver Marks.

Packaging

“Universal applicability” was the key aspect in the design of the sensor electronics and the housing technology. In line with this conception, you have to account for the most diverse application criteria. For standard machine engineering applications, chrome-plated brass barrels and standard plastic housings are the best and most cost-effective solution. However, the field of car body construction in the automotive industry places additional demands on the design.

In particular our series MT, specially designed for this sector, provides the required degree of mechanical robustness for added protection against weld-splatter, by combining materials, such as high-temperature resistant plastic caps and a teflonized threaded barrel. In the food industry, resistance against cleaning agents and disinfectants (acids and alkalis) and high-pressure steam jet cleaning is the prime consideration. The special WD (wash-down) sensors of the *uprox*®+ line are equipped with a top-grade stainless steel barrel and special LCP caps, as well as with a particular sealing system in the front cap and connector area. The type label is laser-engraved, in order to ensure optimum legibility even after many years”, he states.

Customer benefits

If you want to sell a product successfully, it is not only important to rely on convincing technology but to create additional customer benefits. These come to show in system planning, construction and installation.
“The user can profit from saving additional mechanical mounting components, because the sensors permit partial embedding in metal. Special mounting aids are no longer needed. Installation has become quicker and easier due to the many mounting options. “When working with higher switching distances, higher mechanical tolerances are acceptable; a fact which contributes to operational reliability and thus to cost savings.

In order to avoid mechanical damage, all flush mountable sensors permit recessed mounting. As a result, the sensor is securely protected during operation. Higher tolerances can be employed without jeopardizing system availability. Construction errors can be largely avoided, because mounting errors can hardly occur due to the pre-damping protection and the small metal-free zones. Based on all these factors, an unprecedented level of freedom in the development and construction of new machines and systems has been achieved,” comments Oliver Marks. Purchase and logistics are also facilitated because only a few *uprox*®+ sensor styles are needed to cover the whole range of applications.

“Ford Europe was capable of reducing the number of different sensor types needed by 90 %, without having to suffer any losses in sensing performance”, he states. Therefore Ford has opted for TURCK as a single source supplier for inductive sensors. In all new installations and for retrofitting of existing systems, it is only permitted to install inductive sensors from TURCK. The reason for this decision was that Ford recognized the enormous cost saving potentials in purchase, logistics and operation, if only a few standard sensor types have to be stored. The aspect of optimizing the process costs simply hit the mark.

Applications

Since the product launch in autumn 2004, the TURCK solution has not only convinced the Ford managers. The *uprox*®+ is also applied in the Netherlands, for example, for monitoring the position of slide valves in the production of cheese. Problems used to be caused by the extremely aggressive ambient conditions, due to cleaning agents, disinfectants, high pressure cleaning procedures and the aggressive pickle in which the cheese has to swim”, describes Oliver Marks. The food-grade series WD, featuring an A4 stainless steel housing and a special sealing system, fulfils these exacting requirements. In this application the high IP69K protection rating, as well as the limited space conditions and the high switching distance for stainless steel, were the central factors.

The company Xi Nan Trunk Line Electrification Engineering in China uses the sensor in a monitoring system for overhead contact lines of railway vehicles. “In order to reduce the wear of the moving contact to a minimum, the overhead contact line runs in a zig-zag. Here the *uprox*®+ with its superior technical features is really at its best (magnetic-field immunity, high switching distance, functionality under all mounting conditions).

Development

That the market approves of the benefits of the *uprox*® is reflected by the fact that Turck’s design engineers are still concerned with the product. Our initial target was to cover the range of existing applications with a minimum of product variants,“ explains Oliver Marks. In the meantime, we and our customers have recognized that the sensor’s specific design characteristics open new vistas as clearly demonstrated, for instance, by the overhead contact line application. We are also working on new housing styles. The line of standard housing types introduced a half a year ago will be expanded shortly.

At the Hannover Fair we presented a concept for skid monitoring in the conveyor technology sector; or to mention the open-style tube sensor for small parts detection (screws and rivets in screwing robots), which was included right from the start. In this fashion we will continue to develop further application-specific solutions”, he concludes.

Escha products are virtually the „connecting“ element within the Turck product portfolio

An A&D interview with:
Christian Wolf, Marketing/Management, Hans Turck GmbH & Co. KG, and Axel Kuhbier, Product/Marketing Manager, Escha

In future, the pre-assembled standard connector systems from Escha will be exclusively distributed by TURCK. What advantages do you see in this arrangement?

We consider it necessary to first give some background information on the long-standing association of these two companies. One of our founders and managing directors, Mr. Werner Turck, and a partner founded the company Escha. In the meantime, his son Dietrich has been Managing Director of Escha for several years. Thus, the two companies have always cooperated closely and profited from each other. Escha disposes of an excellent know-how in research & design and production and has been TURCK's supplier of connector products for many years. In the past, we used to work with two distribution channels in Germany – but this arrangement finally lead to some confusion with our customers, despite all coordination efforts. This situation has now been remedied. Another argument is that TURCK, with its 2.300 employees world-wide, features a stronger international orientation and offers the full range of IP67 components for the whole field of automation below the controller level. In this context, connector systems are an integral and important part of our product strategy.

Kuhbier: If you look at the transition of the pure connector market, you will recognize a clear trend towards the full range supplier. Based on the synergies between the companies TURCK and Escha, it does not make sense for Escha to aim at the market position of a full range supplier too. Escha continues to regard itself as a competent developer and manufacturer of IP67 connection and housing technology and fully trusts in the sales support by TURCK.

Which targets does TURCK pursue with this cooperation and where do you see the customer's benefits?

Wolf: The trend towards distributed automation solutions and the widely promoted plug & play philosophy call for a comprehensive approach. For TURCK, as one of the world-wide leading suppliers of sensor and fieldbus products, the range of connection technology is an absolutely strategic product. Escha products are virtually the "connecting" element in our complete product portfolio. For our customers it has become increasingly important to obtain a comprehensive offer from a single source in order to reduce costs and the number of suppliers.Today TURCK is the only company offering complete IP67 solutions below the controller level, alongside the big corporations in our branch of industry. Our target is to dominate the sensor, fieldbus and connection technology markets with innovative products. With the development of our inductive *uprox*®+ sensor and our modular fieldbus system BL67 we have already reached this goal, but we also apply these high standards to our connection technology business. We do not want to be a market attendant, but clearly aim at a leading position.

Escha will now concentrate on customised developments.
What are the implications of this new strategic approach for Escha?

Kuhbier: Our core competences in product development, the company's-own tooling facilities, our moulding and die-cast expertise and the production of electro-mechanical components within the framework of a professional project management, permit us to meet the requirements of today's markets perfectly. Especially in the field of IP67 solutions, the user calls for customer-specific developments, which we will no longer consider as a niche market in addition to our standard components business. We will clearly address such individual projects in future. Based on the customer-specific solutions developed to date, Escha can, of course, demonstrate the successful application of its core competences.

Who will be in charge of new developments in the standard product range?

Wolf: We will, of course, attend to new and further developments in the standard connector and junction system range. In its function as a distribution channel, Turck keeps an "eye on the market". Since our developments are always based on market and customer needs, we consider this as the only practicable method of approach, because otherwise we would be purely planning at the drawing table and that is generally not the most efficient method. The close contact with the technology drivers among our customers has always been one of our strengths and basis of our innovation skills. Moreover, I am convinced that we will be able to draw many new interesting conclusions from the distribution of Escha products, because quite often the insight into other applications in foreign sectors helps to develop inspiring ideas.

How could such “sparking ideas” for connection technology look like?

Wolf: The market definitely calls for an open and economical alternative in the field of quick-connect technology. Various suppliers have lately offered some such products, none of which have managed to succeed, because they lack the forward and backward compatibility needed. As a result, nobody offers a truly open standard.

Will Escha address new sectors or open its doors to TURCK competitors as a service supplier?

Kuhbier: For Escha, both is absolutely true. Historically, our main focus has been on the classical automation sector. Our customized developments include fieldbus housings for TURCK and Beckhoff, passive actuator/sensor junctions for Bosch Rexroth as well as fieldbus housings for B&R. Escha, however, also works with other branches of industry, such as building system automation, sanitary and medical engineering or consumer electronics. In these sectors we have also been able to transform the visions of our customers into application-specific IP67 solutions. In future, Escha will continue to work as a competent and experienced partner for solutions meeting the special challenges of diverse industrial sectors.

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